The South African Journal
of
Medical Laboratory Technology

ORGAN OF THE SOCIETY OF MEDICAL LABORATORY
TECHNOLOGISTS OF SOUTH AFRICA

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CONTENTS

REDAKSIONEEL

Dit kan gesê word dat die grootste krag van 'n vrywillige organisasie lê in die mate van ondersteuning, belangstelling en aktiwiteit wat deur die lede aan die dag gelê word.

Vir baie lede van die Suid-Afrikaanse Vereniging van Mediese Laboratorium Tegnoloë is die besit van 'n ledemaatkaartjie en 'n loue belangstelling in die vereniging se aangeleenthede al bydrae aan die vereniging. Die verkiesing van hoofde is natuurlik baie belangrik en elke lid behoort geesdriftig belang te stel, maar belangstelling behoort nie na die verkiesing te verflou nie.

Om al die lede van die vereniging te blameer is egter onregverdig. Dit blyk dat daar geen meganisme is waardeur lede gedurig in kennis gestel word van plaaslike gebeurtenisse en algemene vooruitgang van die vereniging nie.

Komitee vergaderings skep die indruk dat hulle in kamera gehou word onder 'n mantel van geheimsinnigheid. Is daar enige middel waardeur die notule van vergaderings of 'n opsomming van bespreekte items en vooraangenome menings aan die lede van die vereniging bekend gemaak word nie? As daar nie is nie, sou dit nie beter wees om so iets aan te durf nie? Belangstelling en bespreking sal aangemoedig word en lede sal 'n daadwerklike ondersteuning of konstruktiewe kritiek kry.

Hoewel lede vertroue het in hul plaaslike gekose hoofde moet hulle nogtans op hoogte van sake gehou word in verband met besluite en vooruitgang van hulle tak van die vereniging. Die algemene beleid van die Nasionale Raad van opvoedkundige komitee is selfs van groter belang en dit is die *reg* van all lede om op hoogte van sake gehou te word omtrent algemene sake en die toekomstige beleid.

Dit is nie genoeg om met gevoue hande te sit en 'n paar mense toe te laat om baie te lei sonder die doelbewuste ondersteuning van die meerderheid nie. Om daardie ondersteuning te verkry, moet die hoofde van die vereniging seker maak dat die lede ter enige tyd op hoogte van sake is met die vooruitgang en werksaamhede van *hul* vereniging.

EDITORIAL

It may be said that the greatest strength of a voluntary organisation is to be found in the degree of support, interest and activity shown by its members.

To many members of the South African Society of Medical Laboratory Technologists, the holding of a membership card and spasmodic interest in Society politics and elections is the total sum of their contribution to the organisation. The election of officers is, of course, of vital importance and every member should be vitally concerned, but interest should not lag when elections are over.

To put the fault entirely with the general members of the Society would be unfair. There appears to be no mechanism by which these members are kept continuously informed of current local and general Society proceedings.

Committee meetings have the appearance of being conducted *in camera* under a strict cloak of secrecy. Is there any means by which minutes of committee meetings, or a summary of items discussed and the resolutions adopted, can be made available to Society members? If not, would it not be preferable to adopt a procedure of this nature? Interest and discussion would certainly be stimulated and committee members would gain either positive support or constructive criticism.

Whilst Society members may have complete confidence in their locally elected officers, they should be kept informed of the decisions, plans and progress of their branch within the Society. The overall policy of the National Council and Education Committee are of even greater concern and it is the *right* of all members to be kept fully informed of current events and future policy.

It is not enough to sit back and allow the few to lead the many without the conscious support of the many. To gain that support the officers of the Society must ensure that members can at any time make themselves fully conversant with the progress and future designs of *their* Society.

Obituary

NEL McWHIRTER, B.Sc.

It is with the greatest regret that we record the death on the 31st October, 1956, in Grey's Hospital, Pietermaritzburg, of Mrs. Nel McWhirter, B.Sc., after a short illness. Mrs. McWhirter, daughter of Dr. and Mrs. Stevenson, was educated at Durban Girls' College and at the Girls' Collegiate School, Pietermaritzburg, from which she obtained a scholarship to the University of Natal. She graduated from the Faculty of Science, with Chemistry as her major subject.

After qualifying she obtained posts with the Natal Provincial Administration, the Durban Corporation Water Department, and the University of Natal.

To those who had the pleasure of working with her, the news of her death was a heartfelt blow. Her enthusiasm, industry, critical faculties and self-efacement will long be remembered.

She is survived by her husband and parents, to whom we offer our sincere condolences.

TAKE WITH YOU WORDS

H. FLEETWOOD HOWARD

Frere Hospital, East London

The student of any technical subject is frequently dismayed at the complexity of the technical words in common use. This probably applies to medicine and its branches more forcibly than to any other subject. As it is tiresome for lecturers to have to explain technical terms which are (or should be) self-explanatory, some discussion on the origins of a few of the words we use in the laboratory may be of value.

An elementary knowledge of Latin and Greek is essential. The student is not necessarily expected to be able to speak, read and write these languages, but he should be able to recognise the more frequently-recurring roots and to know their meanings. Most South African schools include Latin in their curricula and this language presents no particular difficulty. Greek, however, is not widely studied in this country and

has what appears at first sight to be a disadvantage in employing a somewhat different alphabet and script. Some etymological dictionaries laboriously transliterate Greek words into our alphabet and script, but the Greek alphabet is so easily learnt that this hardly seems worth while. It is well worth spending the ten or fifteen minutes necessary to learn it merely for the usefulness of knowing it.

Here it is: (Capital letters, or "uncials" as they are usually called, are not used with great frequency in Greek, but they are included here for the sake of completeness. The small letters are those usually employed in normal or "cursive" writing.)

Uncial	*Cursive*	*Name*	*English Equivalent*
Α	α	Alpha	a
Β	β	Beta	b
Γ	γ	Gamma	g
Δ	δ	Delta	d
Ε	ϵ	Epsilon	e (short)
Ζ	ζ	Zeta	z
Η	η	Eta	e (long)
Θ	θ	Theta	th
Ι	ι	Iota	i
Κ	κ	Kappa	k
Λ	λ	Lamda	l
Μ	μ	Mu	m
Ν	ν	Nu	n
Ξ	ξ	Xi	x
Ο	o	Omicron	o (short)
Π	π	Pi	p
Ρ	ρ	Rho	r
Σ	σ, s	Sigma	s
Τ	τ	Tau	t
Υ	υ	Upsilon	u
Φ	ϕ	Phi	f
Χ	χ	Chi	ch (like k)
Ψ	ψ	Psi	ps
Ω	ω	Omega	o (long)

There are two forms of the Greek equivalent of our "s", the first, σ, is used when the letter occurs at the beginning or in the middle of a word; the second, s, when it is the final letter.

All words beginning with a vowel have a "breathing" sign over the first letter (over the second letter in the case of diphthongs). This is normally written like a comma, thus: $'o\phi\theta\alpha\lambda\mu o s$ (an eye), and is called

a "smooth breathing". A comma written the other way, thus: ὕδωρ (water), is called a rough breathing and has the force of a letter "h" before the vowel sound. The absence of a separate letter for "h" in the Greek alphabet is, therefore not felt. The letter ρ (rho) invariably has a rough breathing.

The letter υ (upsilon) is normally transliterated into English as "y" (as in "sympathy").

When γ (gamma precedes the letters γ, κ, χ and ξ it has the force of the letter "n" in English. For example, σαλπιγξ (a trumpet) is transliterated as "salpinx".

Various "accent" signs are extensively employed in Greek, but have been omitted from this article for the sake of clarity.

Differences occur in printers' Greek type-face just as they do with English letters, but these differences are not marked so far as the cursive letters are concerned and should not present any difficulty.

So if you've learnt your A-B-C in Greek, you've learnt the alpha-beta-gamma, or alpha-bet.

Many Latin and Greek nouns and verbs change their form in varying degrees and, so far as nouns are concerned, the "root" is usually that which occurs in the genitive or possessive case of the parent word. For example, the Greek word φως (light) has the genetive form φωτος and this is the form in which it occurs in our derived words. Similarly English words derived from Latin and Greek verbs seldom contain the lexical form (i.e., the form in which you would find the word in a Latin or Greek dictionary) but usually the participle form. Certain words, originally Greek, have taken on a Latin form before being anglicised. And then there are those horrible monstrosities—fortunately not many—which are the bastard offspring of an illicit union between Latin and Greek.

. . . . . .

The student in the bacteriological laboratory will probably first learn a rough morphological classification. The stem of our word MORPHOLOGY is the Greek μορφη — shape, or form. About the first micro-organism we encounter is the COCCUS. This is almost a straight transliteration of κοκκος — grain. Add to this σταφυλη — a bunch of grapes, and the meaning of STAPHYLOCOCCI should be clear. Another Greek word meaning "bunch of grapes" is βοτρυς. BOTRYOID tumours will be encountered in histology. STREPTOCOCCI are so-called because their chains twist and turn: στρεφω — I turn. The numerical prefixes are easy: mon(o)-, bi- (or di-), tri- (or ter-), quad- (or tetra-) and so on. A BACILLUS is a small rod-shaped organism and is named after the Latin word *bacillus* — a small staff or rod. I have seen sodium hydroxide sticks labelled "bacilli" by continental manufacturers. The Greek βακτηριου has the same meaning. It is difficult to understand, therefore,

why the inventor of the word ACTINO-BACILLUS should have elected to take the roots from both Latin and Greek; *'ακτις, 'ακτινος* — a ray, would have been better wedded to *βακτηριον* than *bacillus*. Many linguistic purists, of course, adopt this form, ACTINOBACTERIA. ACTINOMYCES is of purer descent, the second root being also Greek, *μυκης* — fungus. *κορυνη* — a club, is appropriately employed in CORYNEBACTERIUM, and the principal disease caused by the organism, DIPHTHERIA, is named after *διφθερα* — a membrane. This sounds like, but has no connection with DIPTERA, the name applied to two-winged insects. Here the root word is *πτερυγιον* (sometimes *πτερον*) — a wing, and from which we get such words as PTERYGIUM (the "g" is soft), a conjunctival thickening extending over the eyeball and rather resembling a wing, and PTERYGOID.

The names of many genera are eponymic, that is, they contain the name of some person, e.g., Pasteurella, Shigella, etc. The use of eponyms is condemned in some circles, more descriptive appellations being preferred. Sometimes, it is true, we have sacrificed a convenient, descriptive name for an eponym. *B. mucosus capsulatus* left one in no doubt as to the type of organism to which the name applied. *Bact. friedländeri* or *Klebsiella pneumoniae* are less happily-chosen. Personally I don't dislike eponyms provided that they are used with discretion. It is fitting that the Holy Fathers of bacteriology should have their names perpetuated. But I admit that some injustice has been done to Neisser, whose name calls to mind a somewhat infelicitous association to say the least.

Which, of course, brings us to GONORRHOEA. The suffix "-rhoea" means "a flow" and comes from *'ρεω*; *γονη* means "a seed" and the prefix "gon-" means "appertaining to reproduction", e.g., GONADS, GONADOTROPHIC (the "trophic" comes from *τροφη*, food or nourishment). Another Greek word for "seed", *σπερματος*, gives us SPERMATOZOA. The "-zoa" part is from *ζωη* — life, which also gives us ZOOLOGY (Incidentally, another Greek word for "life" is *βιος*, which gives us BIOLOGY.) The Latin word for "seed" gives us SEMEN. A very tiresome Greek verb which is even more irregular than most Greek verbs is *γενναομαι* — I am born, or I become, and occurs in our word GENESIS (lit. coming into being), and all its related words, such as GENITAL, GENE, etc.

An important Greek root comes from *χολη* — bile. The prefix "chol-" should immediately indicate that the word has some connection with bile, e.g., CHOLELITHIASIS (*λιθος* — a stone), TAUROCHOLATE (*taurus* — a bull), CHOLESTEROL (*στεαρ* — fat) ACHOLURIC (lit. no bile in urine) and so on.

Some of the Greek words for colours occur frequently in medicine and are worth learning. *κυανος* — blue, comes in CYANOSED, PYOCYANEUS, etc. The "pyo-" prefix is from *πυον* — pus. (The Latin word for pus, *pus, puris* is also commonly employed.) *λευκος* — white, gives us LEUCOCYTE. The "-cyte" part is from *κυτος* — a cell. *'ερυθρος* — red, gives us ERYTHROCYTE. *ξανθος* — yellow, gives us XANTHOCHROMIA (*χρως*

— colour). χλωρος — green, occurs in CHLORINE. A few Latin colour names are also common, such as *albus*—white, *aureus*—golden, *citreus* —lemon-coloured, and *rubrus*—red.

There are numerous instances in which both Latin and Greek stems are extensively used with the same meaning, e.g., *cor*—καρδια—heart (CORONARY, CARDIAC), *renes*—νεφρος—kidney (RENAL, NEPHRITIS), *dens*—'οδους—tooth (DENTAL, ODONTOID), *auris*—'ως, 'ους—ear (AURAL, OTITIS), *cutis*—δερμα—skin (CUTANEOUS, DERMAL).

It is, therefore, a little surprising to find the Latin word for "blood" (*sanguinis*) so little-used. The Greek αἷμα is almost exclusively used in this connection, e.g. HAEMORRHAGE, HAEMATOLOGY.

POLYMORPHONUCLEAR is a hybrid: πολυς—many, or much; μορφη we already know; but NUCLEUS comes from *nux*—a nut or kernel. LYMPHOCYTE is another hybrid, *lympha* being a seldom-used Latin word for "water". EOSIN, the dye, is named after 'ηως—the dawn; φιλεω means "I love", hence EOSINOPHILE (the cell, of course, has an affinity for the dye, not the dawn). καρυον has the same meaning as *nux* (nut or kernel) hence MEGAKARYOCYTE. "Mega-" is of Greek origin and means "very large".

A fact with which most people are familiar, but which I mention here for the benefit of the few who are not, is that the suffix "-itis" means "inflammation". "Affinity for" is conveyed by "-phile" as mentioned above, and "fear of" is conveyed by the suffix "-phobia" from φοβος—fear, e.g. PHOTOPHOBIA (dislike of light). The suffix "-osis" generally means "too much of" (LEUCOCYTOSIS), but not always. Sometimes it could be construed as meaning "state of" as in AVITAMINOSIS (state of not having a vitamin). This ending should not be confused with "-ptosis", which comes from πιπτω—I fall.

"Hyper-" means "above" or sometimes "too much". "Hypo-" means "below" or "too little". These two prefixes of Greek origin have precisely the same meanings as "super-" and "sub-". which are Latin. Although not used in identical senses by modern anatomists, SUBLINGUAL (*lingua*—tongue) has exactly the same meaning as HYPOGLOSSAL (γλωσσα—tongue).

Three Greek words which were the subject of much cogitation by the ancients are again coming to enjoy an inter-relationship in modern thinking. They are ψυχη, πνευμα and τωμα. The last is easy. It means "body" (same as the Latin *corpus*) and there is an end to it. But the other two are rather tricky and are probably grossly misused in their modern derivatives. ψυχη should strictly be translated as "soul" though in Hellenic Greek—that is, later Greek of about the New Testament period—it is frequently used in the sense of "life". As we use it, of course, it means "mind" and the mind-body interdependence is described as PSYCHOSOMATIC. PSYCHOLOGY is the study of the mind. Perhaps it is rather a pity that we don't use the "psycho-" prefix in its ancient sense. In Afrikaans the ancient meaning is preserved, as in SIELSIEKTE.

πνευμα means "air" or "wind" as in PNEUMONIA, PNEUMATIC, etc., though in Greek as often as not it means "spirit".

Three important Greek adjectives which are extensively used in English derivatives are 'ομοιος—like (HOMOGENEOUS), 'ετερος—different, or another (HETEROPHILE), and 'ιδιος—one's own (IDIOSYNCRASY). A word of warning: not all words starting with "hom-" come from the Greek root. Quite a few come from the Latin *homo*—man.

Two Greek words important in medicine should be well-known, θεραπευω means "I heal" and gives us a whole string of derivatives such as THERAPEUTIC and all allied words. The Greek for a physician is ι'ατρος which gives us the "-iatric" ending common to the names of so many branches of medicine.

Uterus—a womb, is a Latin word. The Greek word 'υστερα has the same meaning. It is interesting that our word HYSTERIA comes from this root. In early times this complaint, apparently occurring only in females, was supposed to be due to a disaffection of the womb. μητρα, another word for "womb", gives us ENDOMETRIUM. The study of female complaints, GYNAECOLOGY, is called after γυνη—a woman.

PEDIATRICS comes from παιδιον—a child. GERIATRICS comes from γηρα—old age. PATHOLOGY comes originally from παςχω—I suffer, of which there are numerous derived words in both Greek and Latin, and which has so many English derivatives that it would be difficult to list them. SYMPATHY, PATHETIC and PASCHAL are but three examples.

One Latin word, *adeps*, and two Greek ones, λιπος and στεαρ all mean "fat", and occur in many medical words, e.g. ADIPOSE, LIPOID, STEATORRHOEA. The Latin word *sebum* (suet) occurs in the same form in English, though with a meaning which, once recognised, is enough to put one off suet pudding for life.

The biochemistry laboratory owes much of its terminology to the classical languages. For a start, BIOCHEMISTRY comes from βιος—life, and χημεια—chemistry. LABORATORY comes from *labor*—work. Somewhat strangely, perhaps, two of the commonest chemical words, ALCOHOL and ALKALI, are of Arabic origin. ACID, of course, is from *acidus*—sour. πικρος—bitter, gives us PICRIC. METHYL comes from μεθυ—wine and 'υλη—wood. ETHYL is from the Latin *ether*. BUTYL comes from βουτυρον—butter.

The HALOGENS (from 'αλς—salt) are salt-producers. Chlorine we have already mentioned. BROMINE comes from βρωμος—stench. IODINE comes from 'ιοδης—violet-like. FLUORINE comes from "fluor spar", the substance from which the gas is obtained. Fluor spar is so named because of its fluorescent properties.

An interesting example of an error in transliteration is afforded by GLUCOSE. The Greek υ is correctly transliterated as "y", and the Greek stem from which "glucose" derives is γλυκος—sweet. The error occurs only in the name of the sugar itself. All derived words preserve the "glyc-" stem which is correct, e.g., GLYCOGEN, GLYCOSURIA.

The Greek word for "thirst", διψα, occurs in POLYDIPSIA (lit. much thirst). POLYURIA (ουρον—urine) is self-explanatory. DIABETES is a straight transliteration of διαβητης—a syphon, which in turn derives from δια—through, and βαινειν—to go. The aptness of this name for a disease whose principal symptoms are polydipsia and polyuria is obvious. The two forms of the disease, MELITUS (from μελι—honey) and INSIPIDUS (lit. tasteless) recall a urine test which, let us be thankful, is now obsolete.

The Greek word for "to eat is φαγειν and has many offspring. Such words as PHAGOCYTE and BACTERIOPHAGE should, if you have read as far as this, be self-explanatory. Eskimo dogs are said to eat faeces and are described as COPROPHAGUS (κοπρος—dung).

The prefixes of Greek origin indicating size are probably well-known but I mention them for the sake of students. "Mega-" means "very large". "Macro-" means just "large" and "micro-" means "small". πολυς—many, or much, I have already mentioned. The somewhat derogatory expression, "hoi polloi" is straight Greek—οι πολοι. The Latin word *multus* has the same meaning and the purist would much prefer MULTIVALENT (*valeo*—I am strong) to the hybrid POLYVALENT.

Tuberculum—a small nodule, gives us TUBERCULOSIS, the characteristic pathology of which is the presence of small nodules or tubercles in the tissues. The MILLIARY form of the disease is so-called because of the resemblance of the innumerable small lesions to millet.

The words for the senses are important and are mostly well-known. *Audio*—'ακουω—I hear, gives us AUDIBLE and ACOUSTIC. *Video*—σκοπεω—I see, has many obvious derivatives. *Tango*—'απτομαι—I touch, occur in TANGENT and HAPTENE. Two Greek words for "smell" are both used in medicine, 'οσμη (OSMIC) and 'οσφρησω, the latter being directly transliterated as OSPHRESIS, which is a legitimate technical word for "sense of smell". *Olfactus*, the Latin word for "smell", gives us OLFACTORY. OSMOSIS has no connection with these two words and comes from 'ωσμος—impulsion. OZONE comes from 'οζειν—to smell. *Gustus*—taste, gives us GUSTATORY.

Onomatopoeic words (i.e., words resembling sounds) have little place in laboratories, but a good example is BORBORYGMUS, which is identical with a Latin word of the same meaning. It describes quite well the gurgling noise made by the passage of gas through the bowels, "squirting sounds like Yiddish vowels" as they were once described by a peripatetic correspondent in the Lancet. Various sounds heard in the chest have very descriptive names but it would be out of place to mention them here. The instrument used for listening to these sounds is a STETHOSCOPE. στεθος—chest is well-chosen, but the word should really end with "-phone" (φωνεω—I hear).

Certain anatomical terms are highly descriptive. The bunch of spinal nerves at the lower end of the spinal cord in that region of the spinal canal from which cerebro-spinal fluid is withdrawn, is called the

CAUDA EQUINA (lit. horse's tail), an excellent description. The bone which supports the nasal septum is the VOMER (lit. ploughshare) which is also apposite. The SPHENOID bone is named after σφην—a wedge, but this requires quite a good imagination to see the connection. The SELLA TURCICA (lit. Turkish saddle) is a very good descriptive name for the bony structure which contains the pituitary gland. The MITRAL valve of the heart is so-called because of its resemblance to a bishop's mitre—a resemblance, I might mention, which requires a better imagination than mine to perceive. A histological term which may be of interest is TERATOMA, which comes from τερατος—a wonder. Anyone who has seen a really good specimen will appreciate the aptness of the name. σπλαγχνα—entrails, gives us SPLANCHNOLOGY and related words. It is interesting to note that σπλαγχνιζομαι means "I have compassion on" and suggests an unusual psychosomatic connection.

The increasing use of "high-sounding", pretentious names is stupid and irritating, and when carried to extremes can become ridiculous. An ophthalmologist to-day would be offended if you called him an "oculist" (which is precisely the same thing to the man of average education), and technicians nowadays apparently prefer being called "technologists" (τεχνη—art). Dental mechanics are now called "mechanicians" by Act of Parliament. A few more years and they will doubtless be called "mechanologists". My dentist, I am pleased to say, still calls himself by the conventional appellation, though he would hold a much higher place perhaps in the esteem of certain patients if he were an odontologist. (When suffering from toothache, it might lighten the affliction if you realise that its legitimate medical name is "odontalgia".) The ultimate absurdity has been reached in the official designation of the ear, nose and throat specialist: "otorhinolaryngologist" suggests a Welsh place name more than anything else on earth.

And so I could go on, almost indefinitely. If anyone has been stimulated by this article to delve further into this fascinating subject of medical semantics, he will be sure of gaining a rich reward in interest and knowledge. And he will learn that the classical languages are far from being "dead". Though we might hesitate to put the matter as strongly as George Blake, there is something in his dictum that the choice does not lie between a classical education and a technical education, but between a classical education and no education. For it is abundantly obvious that the sciences owe much to the classics and that some knowledge of the classical languages is by no means wasted, even in a purely technical career.

ABERRATIONS OF PARASITISM IN THE CAUSATION OF DISEASE

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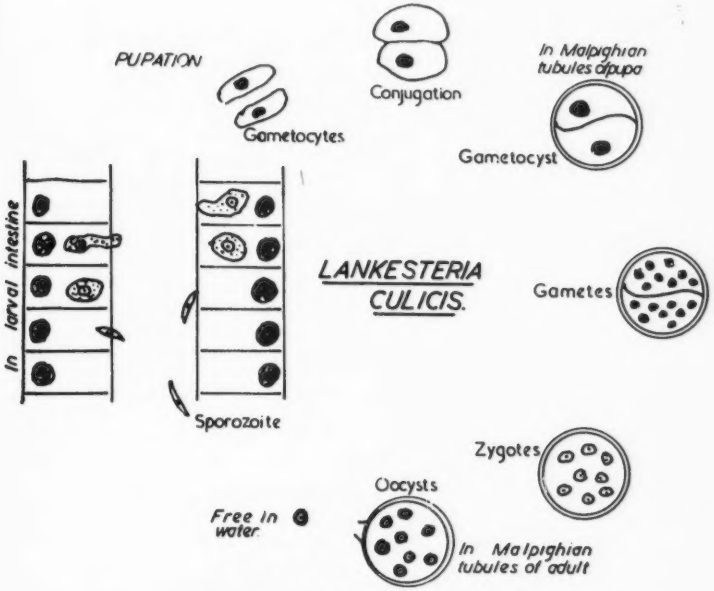
*The Amoebiasis Research Unit is under the joint sponsorship of the South African Council for Scientific and Industrial Research, the Natal Provincial Administration, and the University of Natal.

The efficient parasite does not destroy his host. Even though he is living at the host's expense, the damage done should never be such as to endanger the host and the parasite's source of sustenance. The only cases, and these are exceptional, where it is to the parasite's advantage to destroy its host, are those where one host is eaten by the next. Examples occurring in humans are *Trichinella spiralis* and *Echinococcus granulosus*, for neither of which is the human a "normal" host.

Thus it does seem strange that some parasitic diseases take the toll they do. It cannot be to the advantage of the Malaria *plasmodia* to destroy its intermediate host, any more than it is to the advantage of the chicken farmer to sell all the eggs he produces. It cannot be to the advantage of the amoeba to invade the liver—for what hope of posterity has such an amoeba? The Hookworm should conserve its herd of humans if it is to remain a successful farmer.

We have to go back into the evolution of parasitism to explain some of these features and a good example is Malaria—a disease which *still* kills more than any other, and one which restricts human development of many fertile areas of this earth.

The Malaria parasites belong to the class *Sporozoa*, all of which are parasitic, and which contains numeries species. However, we are concerned mainly with the *Telosporida* orders: Gregarinidia, Coccidia and Haemosporidia, in all of which are to be found parasites of insects, birds and mammals. In the Gregarines as a rule there is no asexual multiplication and a typical life cycle is shown by *Lankesteria culicis*—affecting the mosquito. Entering by the mouth of the larva, the sporozoites invade the intestinal epithelial cells, grow and are set free in the lumen. Here they unite in pairs—forming a cyst and migrating to the Malpighan tubules of the mosquito pupa. In this site the nuclei of each member of the original pair divides into equal gametes, when the two parent cells fuse, and the gametes now join their opposite numbers and inside each sporocyst eight sporozoites are freed to complete the cycle. Thus there are eight zygotes from each original pair of gametocytes and no asexual multiplication. In the Coccidia, the process is a little more complex as there is a schizogonous cycle in which the trophozoites

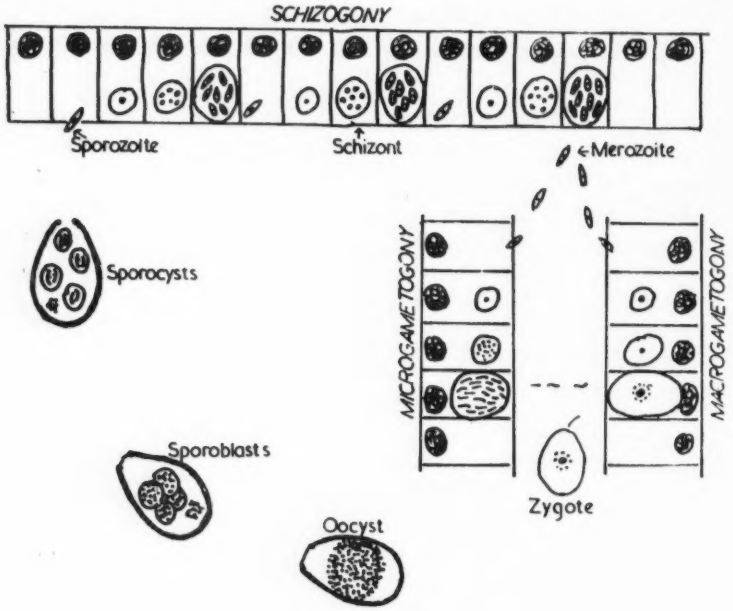


LIFE-CYCLE OF A GREGARINE.

multiply in an asexual cycle. Here one may use as an example Eimeria —in which the sporozoite, after invading the epithelial cell, divides and when the epithelial cell ruptures many merozoites are set free, each capable of invading another epithelial cell and repeating the process. After a number of such cycles, some of the merozoites develop into gametocytes of two different kinds. Whereas in the Gregarines, the gametocytes were of the same size, in the Coccidia macro- and micro-gametocytes are formed. The macrogametocytes divide into numerous micro-gametes, one of which fuses with the large macrogamete (which has not divided) to form a zygote. This zygote—having formed a cyst wall is passed in the faeces—and under aerobic conditions divides to form four sporocysts, each containing two sporozoites. Here there is a multiplication both in the tissue cells of the host and in the sexual form which is in this case outside of the host.

However, in the *Lankesterella* occuring in frogs the schizogony and gametogony take place in the endothelium and the sporozoites enter the blood cells to be taken up by a leech and transmitted to the next host with no further development.

The next evolutionary development is perhaps to be seen in the *Leucocytozoon* and *Haemoproteus* of birds in which schizogony takes



EIMERIA

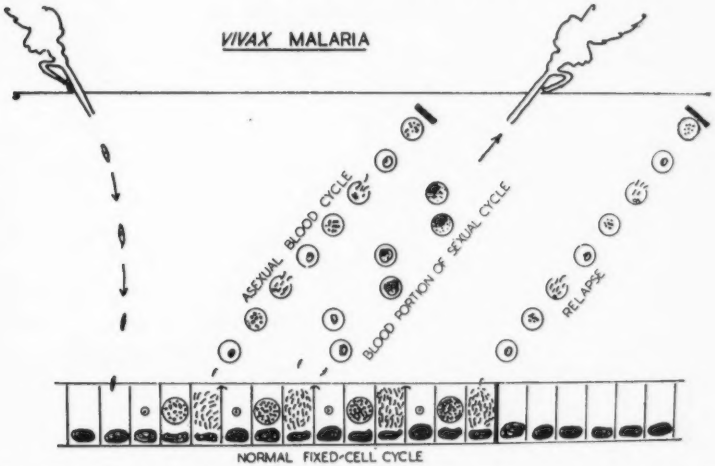
places in the endothelial system and only the gametocytes are to be found in the blood cells. All the asexual phases are exoerythrocytic. The *Plasmodium kochi* of birds has all its schizogony in the liver and the gametocytes alone appear in the blood.

Coming now to the human, *Plasmodium vivax* probably illustrates better than most the evolutionary switch which is associated with pathology. In this parasite, the erythrocytic schizogony does the parasite no good at all and probably harms it by destruction of the host. The main cycle is the exoerythrocytic phase occurring in the liver—the cycle in the red cells is a side issue. The sexual phase commencing in the red cells and finishing in the mosquito is essential to the parasite. It is unlikely that the gametocytes arise from merozoites released from red cells, but they arise from the cryptomerozoites of the exoerythrocytic cycle. The maintenance of the parasites is by this cycle and the red cell stages play no part in the continued existence of the species. If trophozoites of *P. vivax* are inoculated from one case to another, the disease neither relapses nor are gametocytes produced!

Plasmodium malariae has a similar cycle, but there is evidence that merozoites from the erythrocytic cycle may re-enter the tissue cells.

The picture with *P. falciparum* is not clear, but there is some suggestion that here gametogony may follow the red cell cycle, and in these two parasites the cycle in the red cells plays some part in the maintenance of the cycle.

It is, of course, the erythrocyte cycle of malaria which causes damage to the human by the destruction of blood and the release of pigment and other toxic bodies—and yet in *P. vivax* infections anyway, this process does not aid the parasite in any way. This invasion of



the red cells may be an evolutionary experiment, but at the moment the parasite species would be better off without it, as more victims would be available to act as hosts to the *Plasmodium*.

The *Isospora* of man, which must have been with us for many years and in quite a reasonable weight of infection, have not made themselves blatant in their attack and we have not been able to find their pathology —the finding of their oocysts has been incidental. They must have reached a balance with their host and must be classed as "efficient" parasites.

When *Entamoeba histolytica* lives a commensal life in the bowel, it goes on reproducing its cysts perfectly happily, but when it embarks on invasion, cysts are no longer formed and that particular strain of amoebae must eventually die—either when it manages to kill its host or the host retaliates in like fashion.

The moral pointed by this note is that endangering the life of the host is but seldom of value to the parasite, and when this occurs it is frequently due to some accident or aberration of the normal life cycle of the parasite.

A ONE-SOLUTION TRICHROME CONNECTIVE TISSUE STAIN

D. L. LLOYD

Department of Pathology, South African Institute for Medical Research, Johannesburg

The traditional connective tissue stains of Mallory and Masson have been modified by many workers in an attempt to produce a stain which is simpler to use, more consistent, and not so easily affected by the method of fixation.

A natural development from the original trichrome stains is the production of a single-solution trichrome stain which contains the three primary dyes in such proportions that their staining properties remain selective. Two methods have been published, namely, those of Cason (1950) and Pollak (1944), but these methods have in our hands proved erratic and unsuitable for use in a routine laboratory where the tissues are often received inadequately fixed or fixed in unsuitable fluids.

One disadvantage of the Pollak formula lay in the fact that the stains are dissolved in 50% alcohol. It was therefore decided to follow the principle of the Masson stain (1929) in which the dyes are dissolved in acetic acid, and to modify the proportions of the dyes. As the green or blue element seemed to be more powerful in its staining properties, the red dye was increased in concentration.

The following stock solutions were prepared:—

Stock Solution A: 2% Merck's acid fuchsin in 2% acetic acid.

Stock Solution B: 2.5% Merck's light green in 2% acetic acid.

Stock Solution C: 5% Phosphotungstic acid in *Aq. dest.*

Stock Solution D: 3% ponceau fuchsin (Gurr's)
1.4% Acid fuchsin (Merck's) } in 2% acetic acid.
3% Orange G (Merck's)

The one-solution trichrome stain was prepared as follows:—

Stock Solution A: 5 ml.

Stock Solution B: 5 ml.

Stock Solution C: 5 ml.

Stock Solution D: 3 ml.

The stock solutions must be added in the order stated. Preparation of the staining solution from powdered stains directly, i.e., without using previously prepared stock solutions, proved unsatisfactory.

Method of Staining:

1. Dewax and hydrate sections.
2. Wash in distilled water.
3. Stain for 6 minutes in Weigert's Iron Haematoxylin.
4. Blue thoroughly in tap water.
5. Trichrome mixture—10 minutes.
6. Wash in tap water.
7. Dehydrate quickly in absolute alcohol.

Clear in xylol and mount in D.P.X. medium.

This method gave consistently satisfactory results with formol-fixed material but Zenkerizing for one hour before staining was necessary in those cases where tissues were partly autolysed or imperfectly fixed. No deterioration in staining properties of the mixture was noted after several weeks.

Results:

Muscle—bright red.
Collagen—blueish-green.
Nuclei—purplish-red.
Erythrocytes—orange.
Elastic tissue—pale red.

In liver section the bile canaliculi were clearly demonstrated and could be traced from cell to cell.

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PURCHASE OF TEXTBOOKS

Arrangements have been made for members of the Society to purchase laboratory textbooks at a discount. The bookseller concerned has indicated that this discount will only be obtained on bulk orders, which should be made through Branch Secretaries, from whom details of the scheme may be obtained.

THE SOCIETY'S BADGE

Members may obtain enamelled badges from the Hon. General Secretary, c/o Central Laboratory, Private Bag, Jacobs, Natal, at a cost of 5s., plus 6d. post and packing. When ordering please state whether pin badge or lapel stud is required.

ATYPICAL CASES OF SALMONELLA INFECTION

M. A. E. BENNETT and P. N. BUCK
Pathological Laboratory Service, Natal Provincial Administration

INTRODUCTION

Organisms of the genus Salmonella are usually associated with either an enteritis or a septicaemia, the great majority causing the former type of infection (Wilson and Miles, 1955). The finding of members of this group in association with conditions other than those of an enteritic or septicaemic nature appears to be rare. Over a period of seven years in England and Wales only eight cases, not falling under either of the above headings, were described (Report, 1950a), whereas 3,193 outbreaks of food poisoning due to Salmonellae were listed. On another occasion, six cases, not of an enteritic or septicaemic nature, were reported over a period of one year, compared with a total of 1,369 cases of Salmonella food poisoning in the same period (Report, 1950b). An isolated instance of an atypical Salmonella infection was reported by Jones (1951). In the United States, in a survey covering a period of seven years, Edwards and Bruner (1943), report the isolation of Salmonellae from non-enteric or septicaemic circumstances in only 14 out of a total of 3,090 isolations, an incidence of about 0.45%.

In a period of about two years, five unusual manifestations of Salmonellosis have been noted among the 365 Salmonellae isolated at King Edward VIII Hospital, Durban, in the same period. Brief descriptions of the cases follow.

Case 1.

An Indian male, aged 45 years, was diagnosed as diabetes mellitus (fasting blood sugar: 282 mgms. per 100 ml.) He had an abscess of the neck. A specimen of pus from the abscess was submitted for bacteriological investigation. No organisms were seen in a direct film of the pus, but a non-lactose fermenting, Gram-negative bacillus was grown in pure culture. The organism was motile and gave the primary biochemical reactions of a Salmonella and it was agglutinated by a polyvalent Salmonella antiserum. The culture was submitted for identification and was found to be a strain of Salm. typhi murium (1, 4, 5, 12: i: 1, 2). The patient was discharged after a course of insulin and antibiotics.

Case 2.

An African male, aged 3 months, was admitted with amoebic dysentery, trophozoites of E. histolytica being demonstrated in the faeces. On examination a hepatic abscess was found and aspirated pus was sent for laboratory investigation. Amoebae were not demonstrable in the pus and no organisms were seen in a direct film, but a non-lactose fermenting, Gram-negative bacillus was grown in pure culture. The organism had the characteristics of a Salmonella, and was later identified as Salm.

johannesburg (1, 40: b: e, n, x). The same organism was also isolated from the faeces. The child died a week after admission.

Case 3.

An African female, aged 8 months, was admitted as a case of nephritis. There was a history of pyrexia and convulsions, and a specimen of cerebro-spinal fluid was submitted for laboratory investigations. The specimen was markedly turbid and a direct film revealed the presence of Gram-negative bacilli. A pure growth of a non-lactose fermenting organism was obtained. It had the characteristics of a Salmonella and was later shown to be Salm. umlazi (13, 22: z^{10}: 1, 5). The patient showed gradual improvement for three weeks but then died suddenly.

Case 4.

An African male, aged 5 months, was admitted as a case of meningitis, and turbid cerebro-spinal fluid was sent to the laboratory. A direct film revealed Gram-negative bacilli, and culture yielded a pure growth of an organism with the characteristics of a Salmonella, which was later shown to be Salm. dublin (1, 9, 12: g, p:-). The patient died twenty minutes after admission. *Post mortem*, Salm. dublin was isolated from the gall bladder.

Case 5.

An Indian female, aged 4 months, was admitted as a case of toxic gastro-enteritis. No bacterial or parasitological pathogens were isolated from the faeces and after one week the patient was discharged. Three weeks later she was re-admitted with signs of meningitis and diarrhoea. A small quantity of purulent C.S.F. was submitted and was shown to contain Gram-negative bacilli. A heavy, pure growth of a Salmonella-like organism was obtained on culture, and it was later shown to be Salmonella johannesburg (1, 40: b: e, n, x). The child died the day after re-admission.

DISCUSSION

It is interesting to note that all of the internal infections in this series were fatal, and that they were all in children of less than one year of age.

The types of Salmonellae isolated are also of note. In one case the organism was Salm. dublin, and this organism has been found to be the Salmonella most commonly producing unusual infections in England and Wales. One report records the finding of Salm. dublin in five out of thirteen unusual cases of Salmonellosis (Report, 1950a); and another stated that this organism was responsible for six out of eleven unusual cases (Report, 1950b). A single case of prepatellar bursitis due to Salm. dublin has also been described (Purnell, 1952).

The case here presented of a neck abscess due to Salm. typhi murium was apparently unusual. It is most frequently the cause of food-poisoning (Wilson and Miles, 1955), and is rarely the case of any other type of infection; among over 3,000 cultures examined by Edwards and Bruner (1943), there were only two unusual infections by this organism,

and one of those was isolated from a blood culture, the other being an isolation from a urine in a case of prostatitis. Two cases of meningitis due to this organism (Reports, 1950a and b), and an infection of an old leg sinus (Report, 1950a) are recorded.

The two unusual infections by Salm. johannesburg appear to be unique. The organism was originally described in the faeces of two cases of enteritis (Kauffman and Henning, 1952) and does not appear to have been hitherto recorded in association with atypical cases of Salmonellosis.

The infection caused by Salm. umlazi is unusual, that organism having, until this case, only been recovered from intestinal infections.

A hepatic abscess was encountered once in the American series and once in the English series, giving a total of two cases out of 28 unusual infections. Therefore the appearance of a Salmonella-infected hepatic abscess in this small series is rather unexpected.

In the American series Salmonellae were isolated from cerebrospinal fluid in cases of meningitis in 3 out of the 14 cases, and in 4 out of the 14 English cases. The fact that only 25% of these cases were meningitis makes the 3 out of 5 cases here presented a surprisingly high proportion.

SUMMARY

A report is made of five unusual cases of Salmonella infection and interesting features are described.

ACKNOWLEDGMENT

Acknowledgment is made to Dr. H. D. Tonking, Natal Provincial Pathologist, for permission to publish this paper.

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VIRUS STUDIES IN POLIOMYELITIS

Synopsis of a Lecture Given by Dr. R. Schapera

As a result of modern antibiotic treatment, the virus diseases (which are not as a rule susceptible to antibiotics) have become proportionately more important than other infectious diseases which are easily treated by antibiotics. Poliomyelitis is one of the more important of these. The causative virus is almost the smallest known, being 12 to 20 millimicrons in size. Electron microscope studies show that it is a partly rounded, partly square-shaped virus.

By analogy with other viruses it is suggested that the polio. virus consists of a helix of amino acids with a central core of desoxyribonucleic acid. The virus is too small to harbour an enzyme itself, and for this reason it has to rely on outside enzymes to synthesize its requirements. This cardinal difference between the virus and larger organisms such as *Staphylococcus*, for instance, determines the growth properties of polio. virus.

The polio. virus is only able to multiply within a living cell; it grows well in monkey kidney cells, HeLa cells and human embryonic tissue It is considered that, as with other viruses, the method of multiplication of polio. is probably by extrusion of the desoxyribonucleic core into the cell, and the consequent reduplication of this core structure is an initial step in the production of further polio. viruses.

There are three main types of polio. virus—namely, Type I, of which there are 85 strains known; Type II, with 12 strains; and Type III, of which there are three known strains. These different types do show overlapping antigenic patterns, but there is invariably a fairly clear antigenic stimulus for each of the three main types. Consequently, protection against one type only is no assurance that an overwhelming challenge by another type will not precipitate infection.

Clinically, polio. virus can affect people of all ages, but in practice the main victims are between six months and 30 years. In the child, the virus causes an initial illness after an incubation of about two days. This initial illness consists of a rise in temperature, headache and often sore throat. After two days, the child recovers and one to seven days later shows a sharp temperature rise with headache and often stiffness of the neck. This is followed by a paralysis which may be either in the limbs or in the nerve supply, in the breathing, the swallowing and/or eye muscles. The method of infection is generally by direct spread through droplet infection.

As a rule poliomyelitis behaves as a non-clinical infection in that only about 1 to 3 in 100 infected cases show paralysis. Of those clinically recognised cases only very few have permanent paralysis.

The virus may be isolated throughout the whole illness, including the initial stage—diagnosis is by isolation of the virus or by showing the production of antibodies. The best specimens for isolation are stools which, after preparation and addition of antibiotics to prevent the growth of normal bacterial flora, are inoculated into roller tube cultures of monkey kidney or other susceptible cells. These tubes are then examined microscopically at regular intervals, to determine whether the cells have been affected by the inoculum. Polio. virus multiplies rapidly and causes swelling, rounding and later shrinkage and granulation of the cells. The fluid containing the virus is then harvested and put up against hyper-immune polio. antiserum. If the virus is a polio. virus it will be neutralised and, when inoculated into further roller tube cultures, will not be able to produce cytopathogenic changes.

C.C.H.

PATHOLOGISTS' VIEWPOINT

The current medical literature contains several articles on the sex differences in the nuclei of various tissue cells, i.e., polymorphonuclear leucocytes,[1] squamous epithelium of skin from biopsy material[3] and buccal mucosa in smear preparations. [2, 4] More recently it has been shown that from an examination of smears of amniotic fluid it is possible to determine the sex of the unborn child in the latter months of pregnancy.[5]

These investigations are based on the appearance of a chromatin mass found in a high proportion of nuclei in the female subject and associated with the XX chromosome pair. This subject of the sex of human nuclei has been reviewed in a recent issue of the British Medical Journal[6] and it is worthwhile taking note of the warning set out, i.e., that the examiner must have considerable experience in the subject and that the preparations for examination must be of a high order.

The preparations to be examined are readily available to medical technologists and it is hoped that the ethics of the profession will be maintained. These investigations carry possible legal implications and the psychological effect upon the patient, particularly in an hermaphrodite, can be considerable. These procedures are an advance in the subject of histology and are an aid to diagnosis and management of genital abnormalities.

[1] DAVIDSON, W. M., and SMITH, D. R. (1954). *B.M.J.*, **2**, 6.
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J.D.T.

SOCIETY NEWS

CAPE BRANCH

The August meeting took the form of a film evening, with a demonstration of phase-contrast microscopy arranged by Mr. W. Dormer, F.O.A., of Cooke, Troughton & Simms, Ltd. There was a good attendance, and thanks were extended to Mr. G. McManus, of the Surgery Department of the University of Cape Town, for showing the films.

The scheduled lecture for September had to be cancelled, but the Branch expressed its indebtedness to Dr. A. Kipps, of the Department

of Bacteriology of the University of Cape Town, for an excellent talk on "Rhs.", made at very short notice.

The last meeting of the winter took place in October, when Dr. H. W. Clegg, a Cape Town pathologist, lectured on "Staphylococcal Food Poisoning".

SALISBURY & DISTRICT ASSOCIATION OF MEDICAL LABORATORY TECHNOLOGISTS

On the 4th August, the above Association had the pleasure of listening to a lecture given by Dr. M. Gelfand, M.D., F.R.C.P., entitled "The Livingstone Expedition", with particular emphasis on Medicine.

Not only was this talk intensely interesting from the medical point of view, but Dr. Gelfand succeeded, far more realistically than any book, in bringing Livingstone to life. He spoke of the many interesting observations made by Livingstone on malaria, bilharzia and other tropical diseases, and read out some of Livingstone's original words on these subjects. It was fascinating to find how near he came to the truth and yet, in many instances, these diseases were not really understood until years later.

TECHNICAL ABSTRACTS

HAEMATOLOGY

Anti-platelet precipitating antibodies (platelet precipitins) in the serum of thrombocyptopenic subjects. Ruggieri, P. (1955). Policlinico, sez. prat. (Roma), **62**, 1157.

A precipitation reaction was studied in 22 cases of I.T.P., 29 cases of secondary thrombocytopaenia and 38 normal subjects by employing platelet antigen and serum. In 7 cases of I.T.P., in 2 cases of secondary thrombocytopaenia, and in none of the controls the reaction was positive.

The mechanism of the L.E. phenomenon. Schultz, J. (1956). Laboratory Digest, **20**, 3.

After describing the mechanism of the L.E. phenomenon a simple method of detection is stated. Polymorphs are isolated on a glass slide and allowed to come into contact with the patient's serum which contains the L.E. factor. A positive preparation may show any of the stages of L.E. formation.

Factor V Consumption during Blood Coagulation. Douglas, A. S. (1956). Brit. J. Haemat. **2**, 2.

Factor V consumption has been studied in normal blood maintained at 37° C. for one hour after collection. At the end of one hour Factor V has been completely utilised. Factor V consumption has been shown to be defective in blood from patients with haemophilia, Christmas disease or thrombocytopaenia and in patients receiving heparin. The experiments suggest that Factor V must enter the reaction involved in thromboplastin formation at a later stage than antihaemophilic globulin, Christmas factor or platelets.

BIOCHEMISTRY

Colour production and stability in the Folin and Wu method of blood glucose estimation. Dische, S. (1955). J. Clin. Path., **8**, 253.

The density of colour in the Folin and Wu method is directly proportional to the concentration of phosphomolybdic reagent as well as the concentration of reduced copper. It is also inversely proportional to the temperature of the mixture. Initial colour production is immediate, but change in concentration of the phosphomolybdic reagent or in the temperature of the mixture is followed by a slow change in density until equilibrium is reached. The alkaline copper reagent and phosphomolybdic reagent form a photosensitive mixture. Exposure to daylight results in the production of a blue colour unrelated to the amount of reduced copper present. Previous modifications introduced to improve colour stability are discussed and their mode of action con-

sidered. Although some are successful they add additional manipulations to the original technique. A new modification to the original Folin and Wu method is described, which obviates fading and simplifies the original technique.

Rapid colorimetric micro method for analysis of neutral fats and fatty acids in biological materials. Jonnard, R. (1956). Clin. Chem. **2**, 254.

A simple method applicable to samples of the order of 0.0001 to 0.1 gm. (dry weight basis) was developed for routine clinical use. It is based upon the formation of ferric perchlorate derivatives of the hydroxamic acids. The latter are produced when the fatty methyl esters are treated with hydroxylamine in anhydrous media. The reactions involved are quantitative under properly controlled conditions. Each step requires but a few minutes.

A spectrophotometric study of several hydroxamates of biological interest is presented, together with data dealing with normal and pathological blood lipids, stool lipids in sprue and other idiopathic steatorrheic conditions, pancreatic conditions and several types of tissue fats. With the use of micro equipment, the method could probably be extended to analysis of elution products from chromatographic or electrophoretic lipid separations.

BACTERIOLOGY

Necessary disinfecting measures in the post-mortem *room.* Zirner, F. (1956). Zent. f. Bakt. I. Abt. Orig., **165**, 197.

Alarming figures for incidence of tuberculosis among *post-mortem* room assistants in five Berlin institutions are quoted. Instances of other infections are mentioned. Despite precautions, a variety of potentially pathogenic bacteria were isolated from walls, floors, tables and equipment, and those items apparently requiring particularly more efficiency in their sterilisation are listed.

Filters in bacteriological hoods. Siefert, H. E., and Callison, E. G., jr. (1956). Air. Cond., Heat. & Vent., **53**, 72.

An ultraviolet-light irradiated, and air exhausted hood is described with a view to safeguarding technicians working with dangerous bacteria.

On the need for altering bacteriological methods of testing sterility. Kurzweil, H. (1956). Ztschr. f. Hyg. u. Infektionskr., **142**, 256.

This paper describes the resistance of certain sporing bacteria to the normal process of autoclaving, and suggests remedies.

A simple mechanical plate inoculator. Pierce, W. H. (1955). J. Appl. Bact., **18**, 124.

The article describes in detail an apparatus for the mechanical inoculation of "plates" of culture media.

Biological hazards of common laboratory procedures. Hanel, Jr. E., and Alg, R. L. (1955). Amer. J. Med. Technol., **21**, 343.

This is the second article on the above subject and deals with the use of the hypodermic syringe and needle in bacteriology and virology. A list of recommendations is made.

Phillips, G. B., and Reitman. M. (1956). Amer. J. Med. Technol. **22**, 16. This is the fourth article on this subject and deals with the inoculating loop.

NOTICE TO CONTRIBUTORS

All contributions are to be addressed to:—The Editor, The South African Journal of Medical Laboratory Technology, Room 213, Dept. of Pathology, Medical School, Umbilo Road, Durban.

Contributions may be written in English or Afrikaans, and should preferably be typed in double-spacing on foolscap sheets on one side of the paper only.

Figures should be drawn in Indian ink, and all figures and tables should be labelled as such (e.g. Figure 1, Table 1, etc.).

Authors should make adequate references to previous works on their subjects. These should be set out as follows:—Author's surname and initials of Christian names; the year of publication (in parentheses); the name of the journal, which should be abbreviated according to the World List of Scientific Periodicals (see below); the volume number (underlined); and the first page reference.

Example:—Moron, I. B. (1960). J. unsuccess. Med., **20**, 99. References to books should give the author's name and initials, the year of publication, title of book, name of publisher, and town in which published.

References should be arranged in alphabetical order of the authors' surnames. If more than one work by the same author is listed, these should appear in chronological order.

Technologists are reminded that regulations demand that all original articles of a technical or scientific nature must be approved by the heads of their departments before being submitted for publication.

Title abbreviations according to World List of Scientific periodicals

All nouns commence with capital letters, and adjectives small letters. Articles, conjunctions and prepositions are omitted.

Examples:—

J. Amer. med. Ass.	*S. Afr. J. clin. Sci.*
Lancet	*Stain Tech.*
Amer. J. clin. Path.	*J. Bact.*

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Bydrae mag in Engels of Afrikaans geskryf word en moet verkieslik getik wees dubbel spasiering op folio-papier en net op een kant van die vel.

Figure moet in Indiese ink geteken word en alle figure en tabelle moet geëtikeer word as sulks (b.v. Figuur 1, Tabel 1, ens.).

Auteurs moet voldoende referensies gee tot vorige werke oor hulle onderwerpe. Die moet as volg uiteengesit word:—Auteur se familienaam en voorletters; die jaar van uitgawe (in hakies); die naam van die Joernaal, wat moet verkort volgens die Wêreld Lys van Wetenskaplike Tydskrifte (sien hieronder)r die volume nommer (onderstreep); en die eerste pagina referensie.

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Titel verkortings volgens Wêreld Lys van Wetenskapliker Tydskifte

Alle selfstandige naamwoorde moet begin met hoofletters en byvoeglike naamwoorde met klein letters. Artikels, verbindings, en voorsetsels word uitgelaat.

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Indien aanvraag ingedien word voor publisering, sal 24 herdrukke van oorspronklike artikels vry aan beydraers verskaf word. As in tydelike maatreel word bydraers gevra om die koste van publisering van fotos wat saam met artikels gaan self te betaal.

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(Nature, 1869, 1, i, 25)

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